FIG. 1

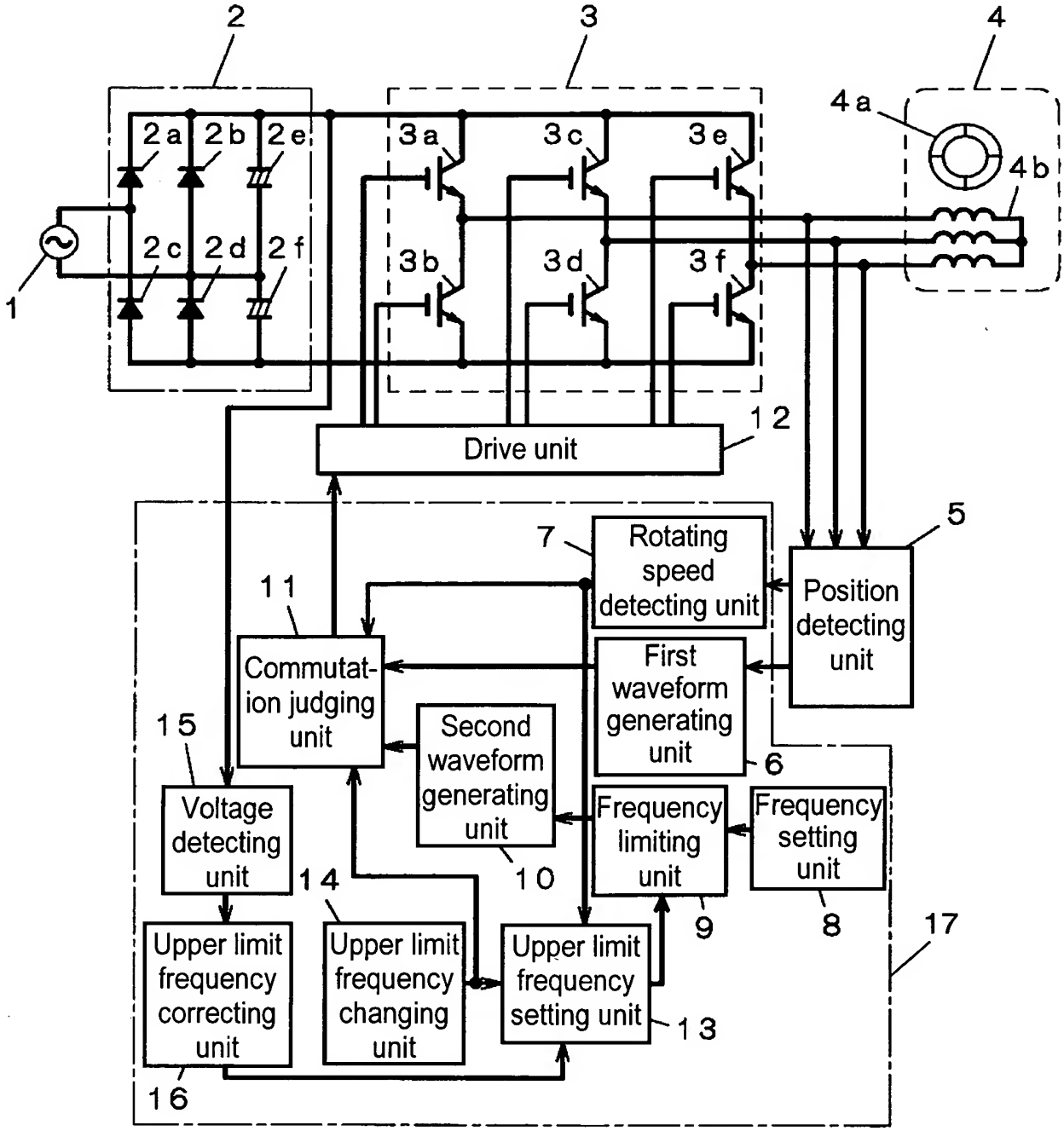

2
3
4
4a
4b
2a
2b
2e
2c
2d
2f
3a
3c
3e
3b
3d
3f
1
12
Drive unit
5
7
Rotating speed detecting unit
Position detecting unit
11
Commutat-ion judging unit
First waveform generating unit
6
15
Second waveform generating unit
Voltage detecting unit
14
10
Frequency limiting unit
Frequency setting unit
9
8
17
Upper limit frequency correcting unit
Upper limit frequency changing unit
Upper limit frequency setting unit
13
16

FIG. 2

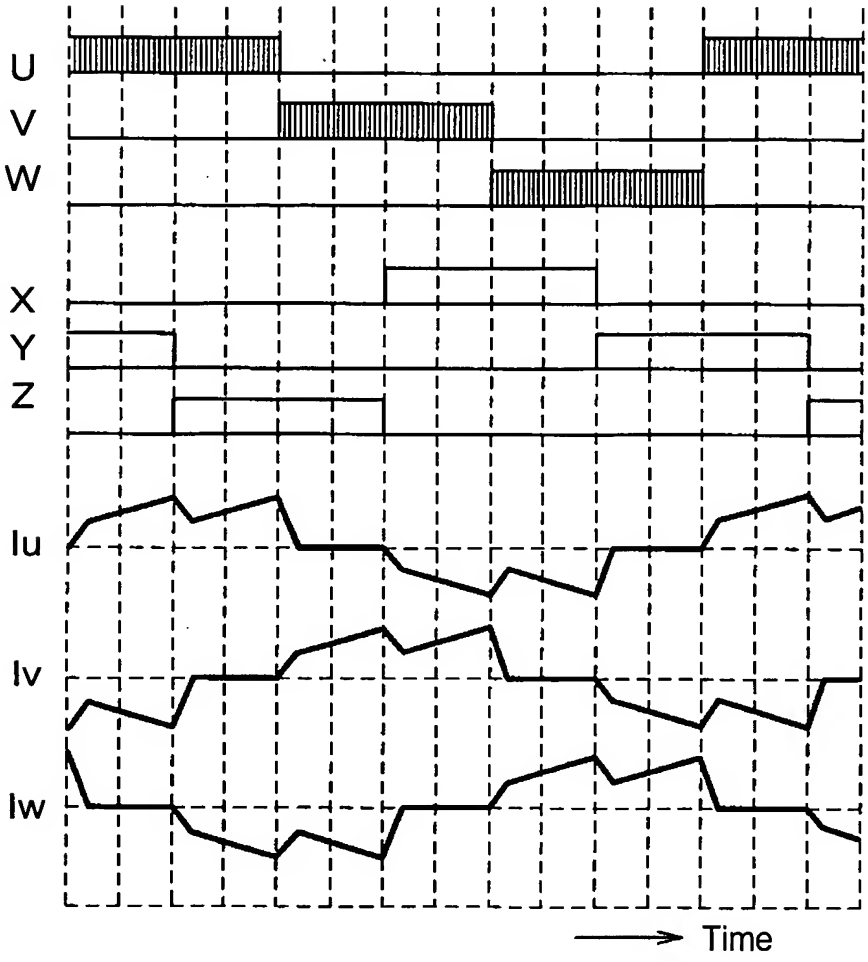

U
V
W
X
Y
Z
Iu
Iv
Iw
Time

FIG. 3

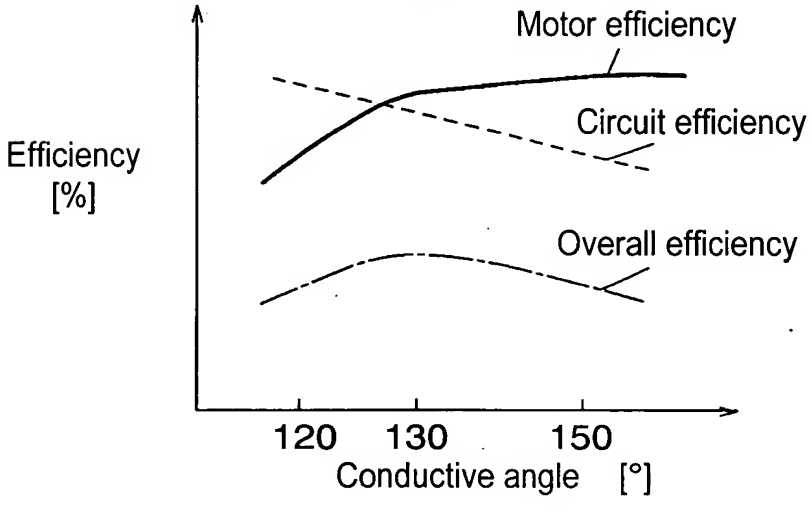

Motor efficiency
Circuit efficiency
Overall efficiency
Efficiency
[%]
120
130
150
Conductive angle [°]

FIG. 4

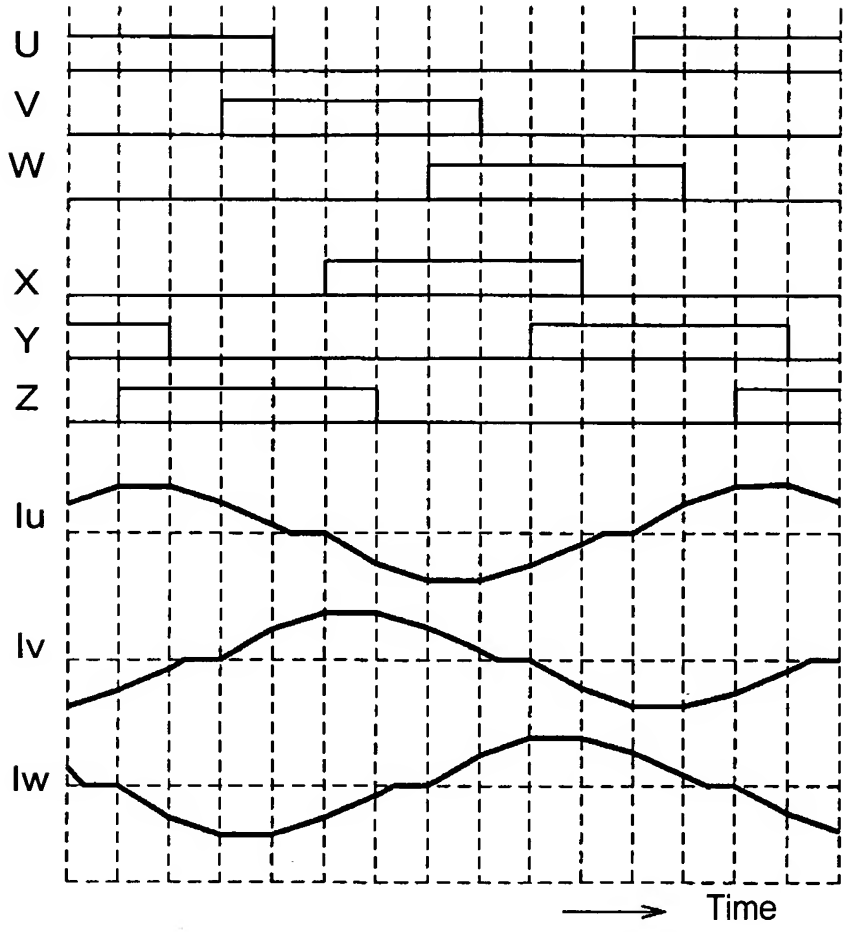


FIG. 5

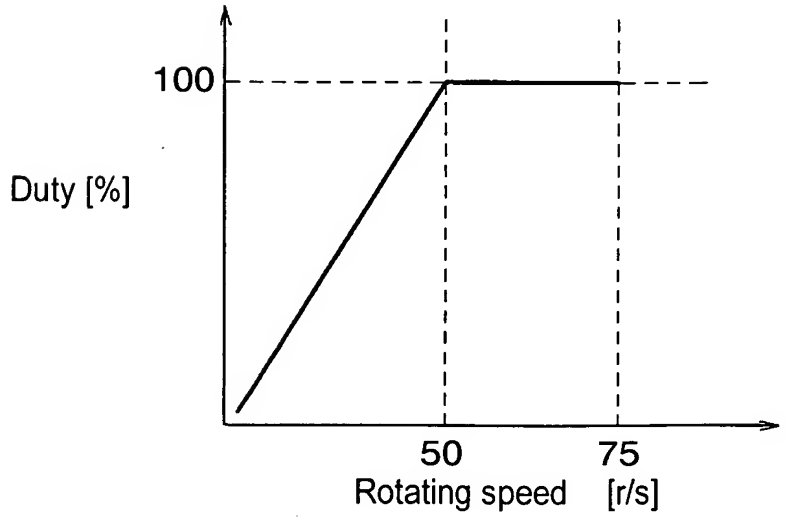


FIG. 6

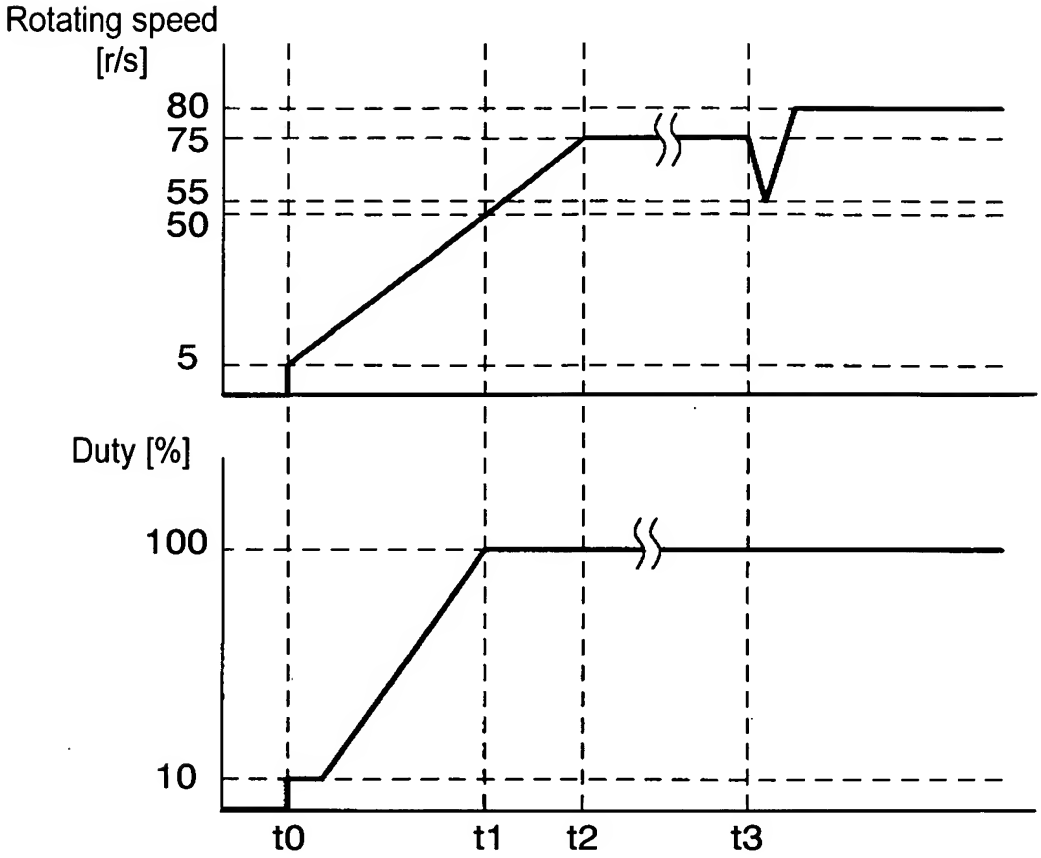

Rotating speed
[r/s]
80
75
55
50
5
Duty [%]
100
10
t0
t1
t2
t3

FIG. 7

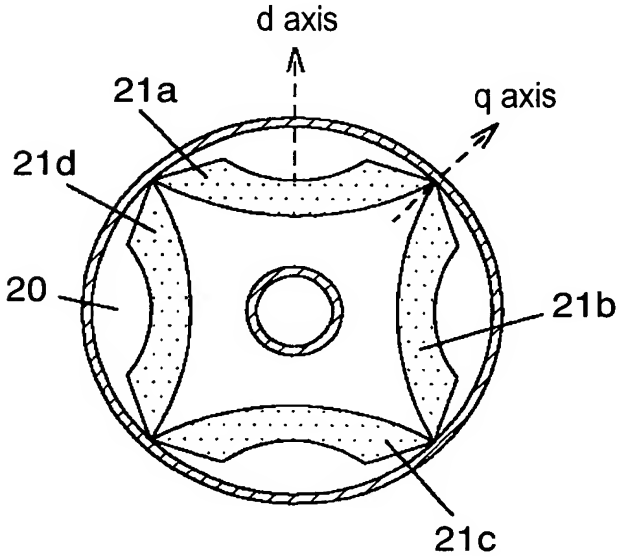

d axis
21a
q axis
21d
20
21b
21c

FIG. 8

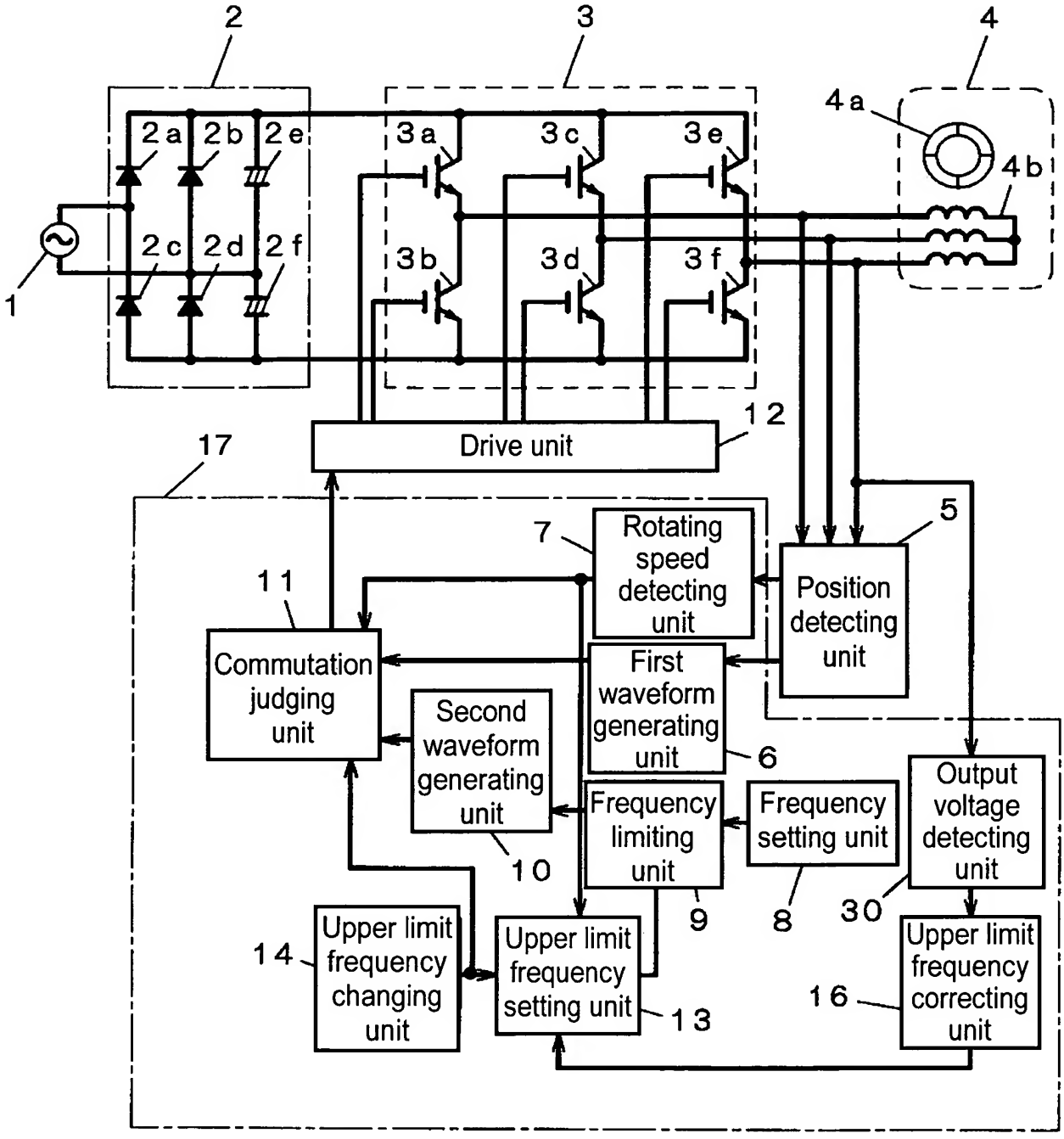

2
3
4
4a
4b
2a
2b
2e
2c
2d
2f
3a
3c
3e
3b
3d
3f
1
12
Drive unit
17
5
7
Rotating speed detecting unit
Position detecting unit
11
Commutation judging unit
First waveform generating unit
6
Second waveform generating unit
10
Frequency limiting unit
9
Frequency setting unit
8
Output voltage detecting unit
30
14
Upper limit frequency changing unit
Upper limit frequency setting unit
13
16
Upper limit frequency correcting unit

FIG. 9

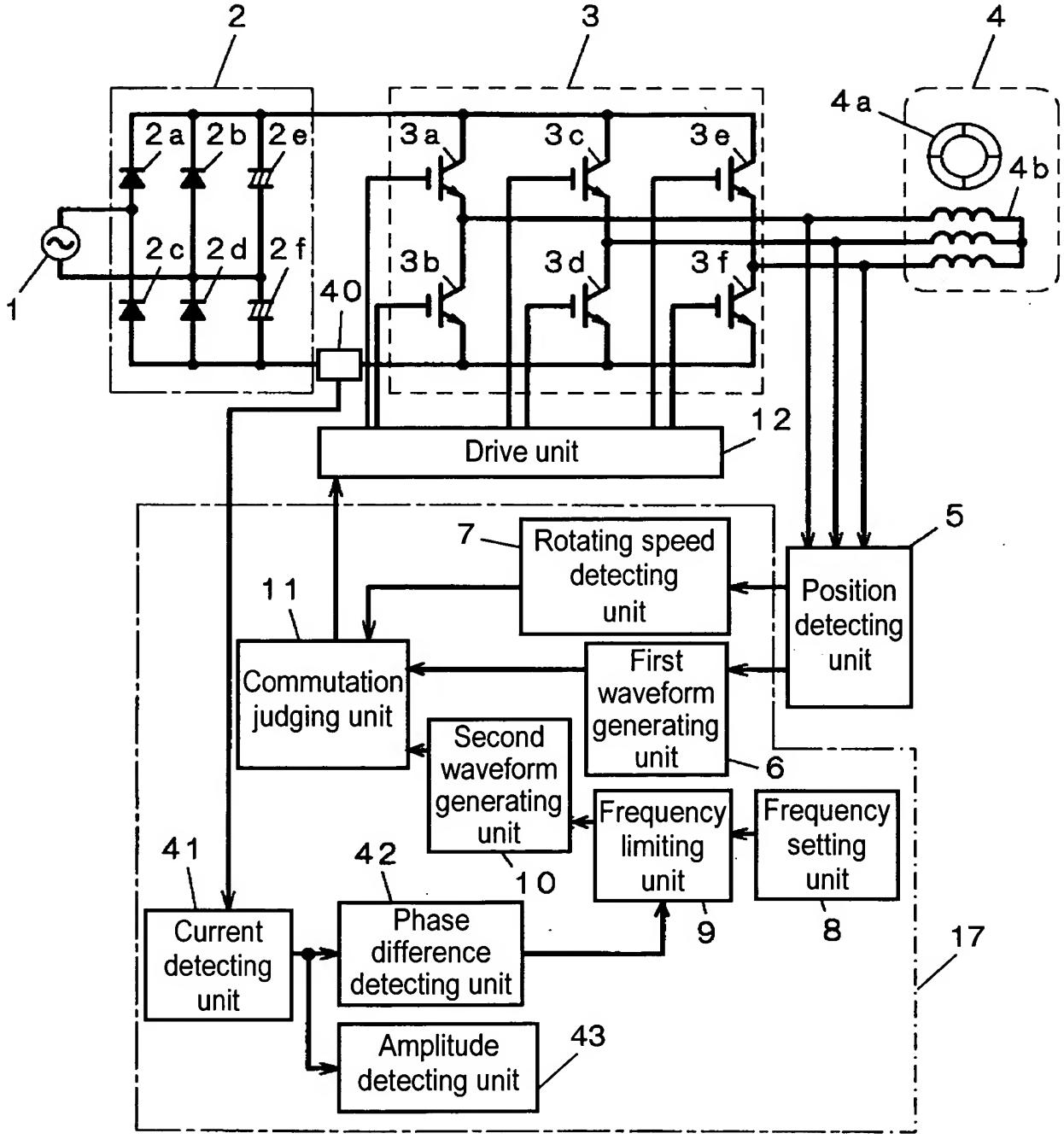

2
3
4
2a
2b
2e
2c
2d
2f
3a
3c
3e
3b
3d
3f
4a
4b
1
40
12
Drive unit
5
7
Rotating speed detecting unit
Position detecting unit
11
Commutation judging unit
First waveform generating unit
Second waveform generating unit
6
Frequency limiting unit
Frequency setting unit
41
42
10
9
8
17
Current detecting unit
Phase difference detecting unit
Amplitude detecting unit
43

FIG. 10

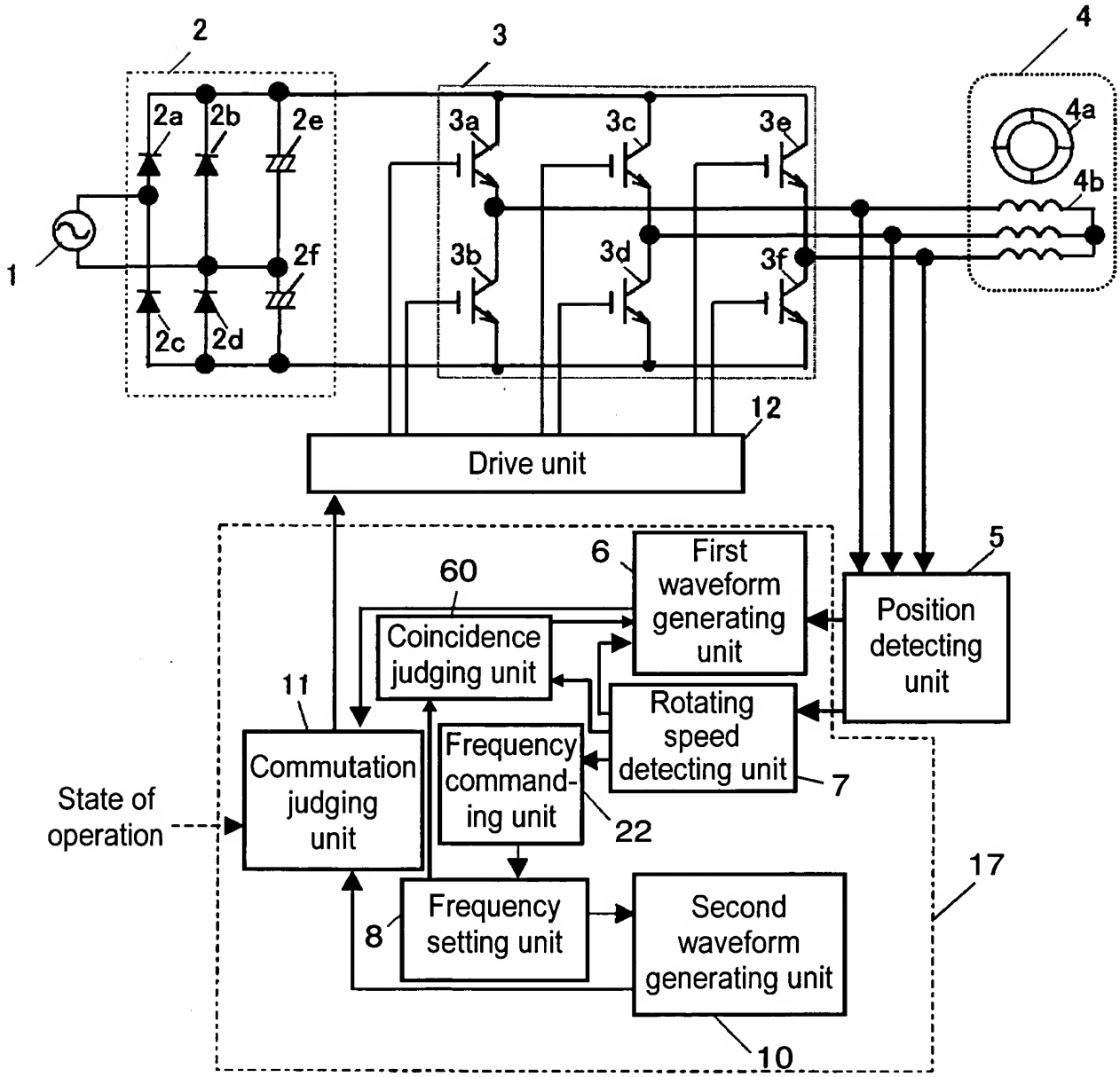

1
2
2a
2b
2c
2d
2e
2f
3
3a
3b
3c
3d
3e
3f
4
4a
4b
12
Drive unit
5
Position detecting unit
6
First waveform generating unit
60
Coincidence judging unit
11
Commutation judging unit
State of operation
Frequency command-ing unit
22
Rotating speed detecting unit
7
8
Frequency setting unit
Second waveform generating unit
10
17

FIG. 11

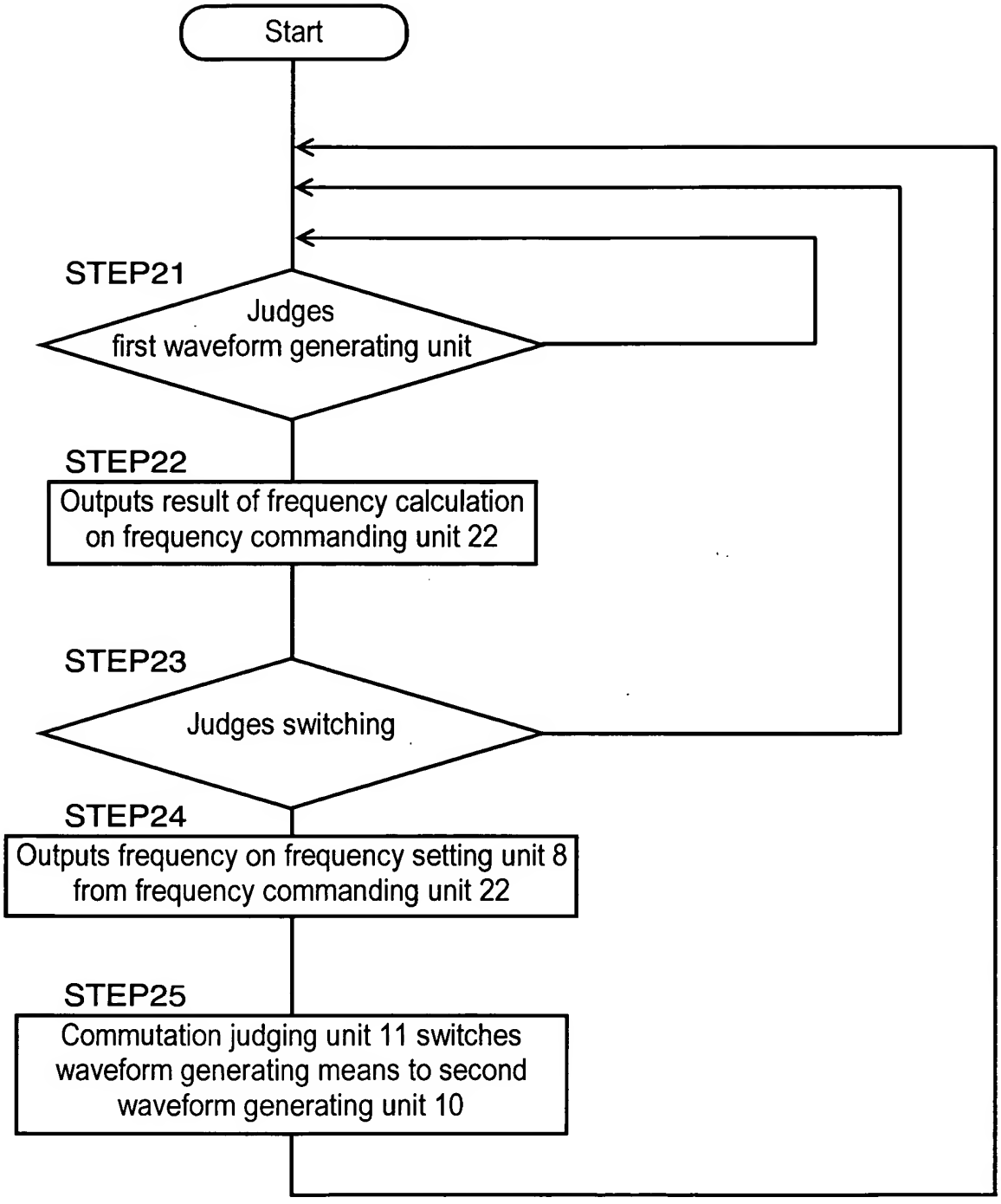

Start
STEP21
Judges
first waveform generating unit
STEP22
Outputs result of frequency calculation
on frequency commanding unit 22
STEP23
Judges switching
STEP24
Outputs frequency on frequency setting unit 8
from frequency commanding unit 22
STEP25
Commutation judging unit 11 switches
waveform generating means to second
waveform generating unit 10

FIG. 12

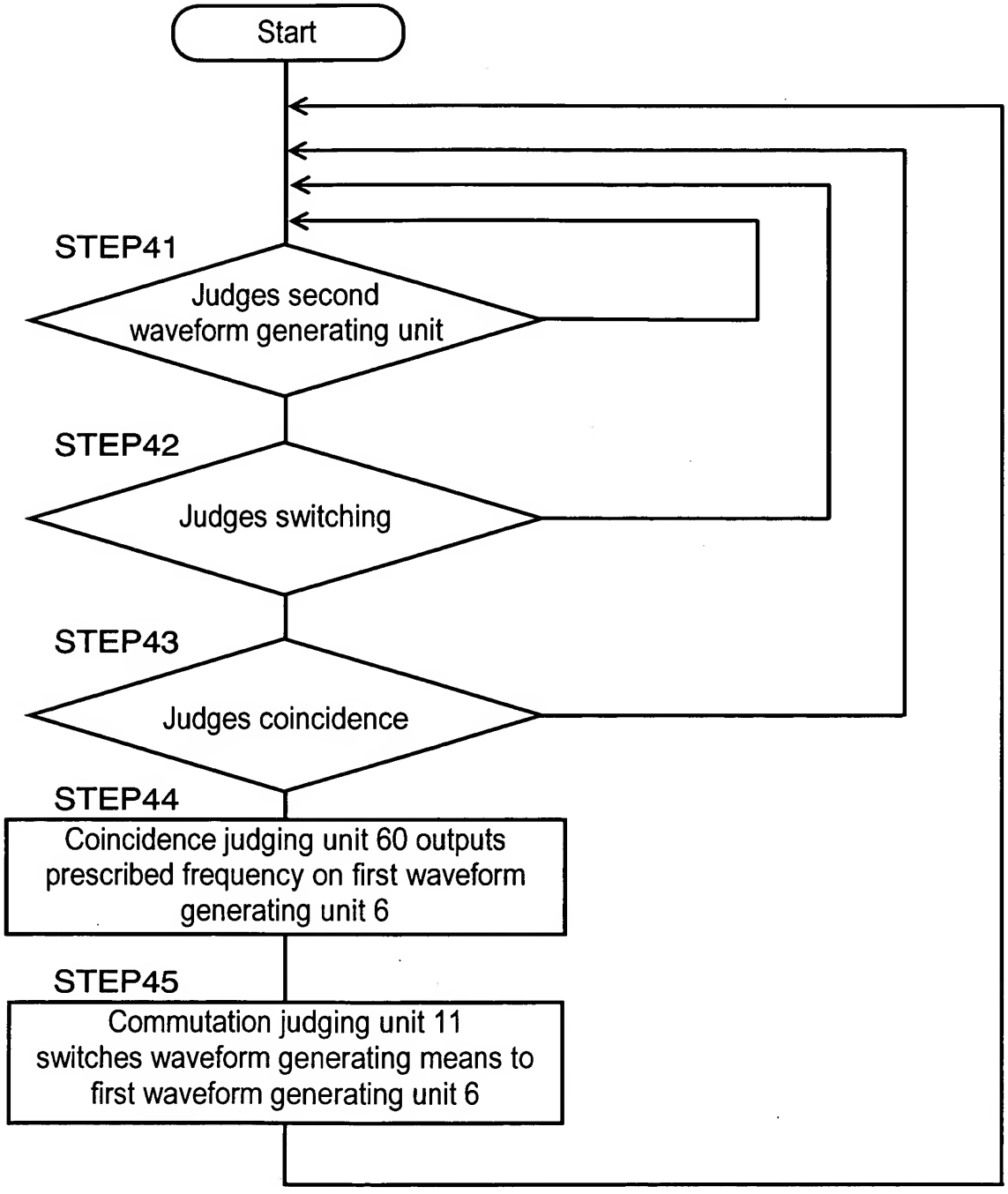

Start
STEP41
Judges second waveform generating unit
STEP42
Judges switching
STEP43
Judges coincidence
STEP44
Coincidence judging unit 60 outputs prescribed frequency on first waveform generating unit 6
STEP45
Commutation judging unit 11 switches waveform generating means to first waveform generating unit 6

FIG. 13

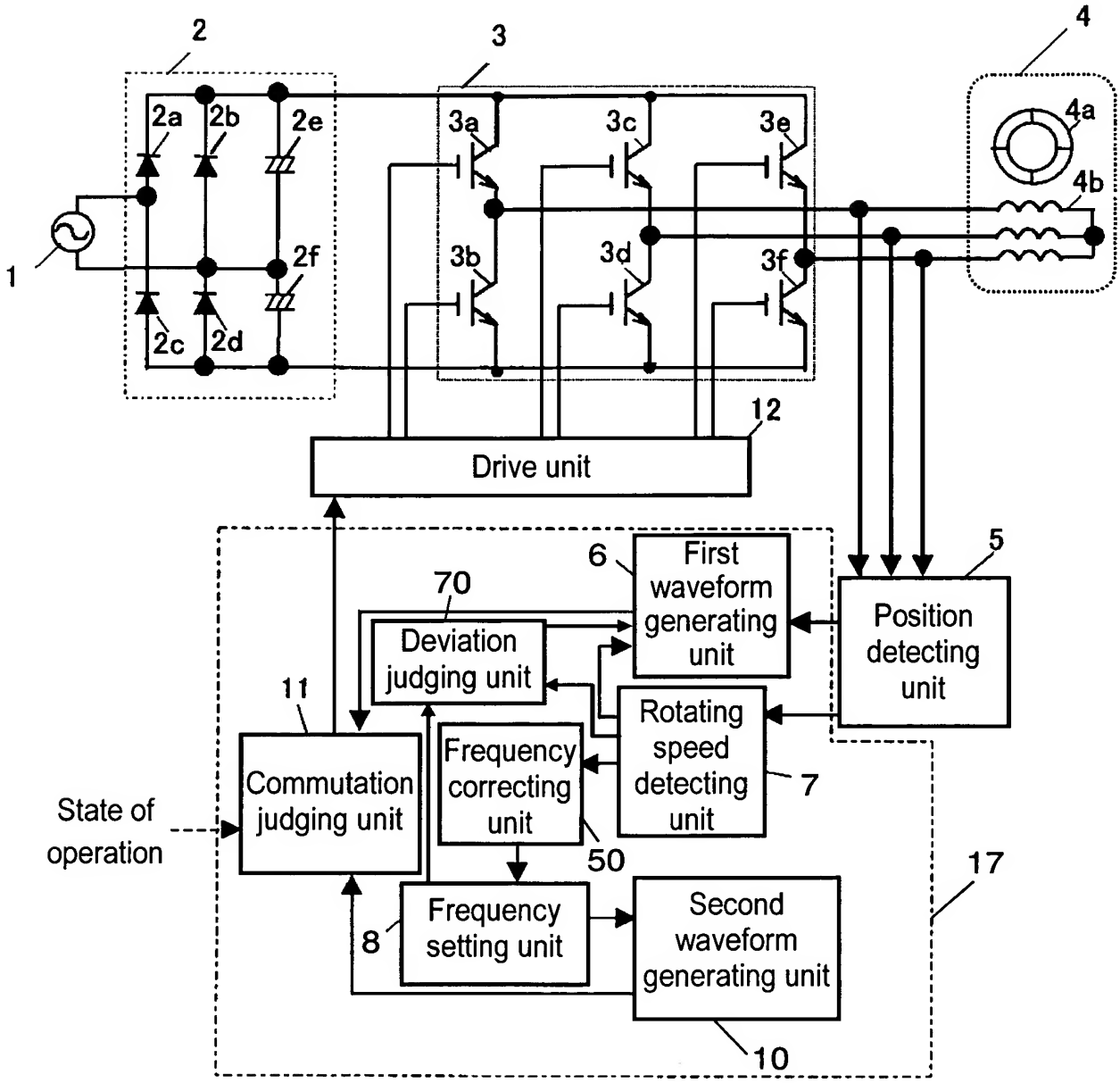

2
3
4
2a
2b
2e
2f
2c
2d
1
3a
3c
3e
3b
3d
3f
4a
4b
12
Drive unit
5
6
First waveform generating unit
70
Deviation judging unit
Position detecting unit
11
Rotating speed detecting unit
7
Frequency correcting unit
Commutation judging unit
State of operation
50
17
8
Frequency setting unit
Second waveform generating unit
10

FIG. 14

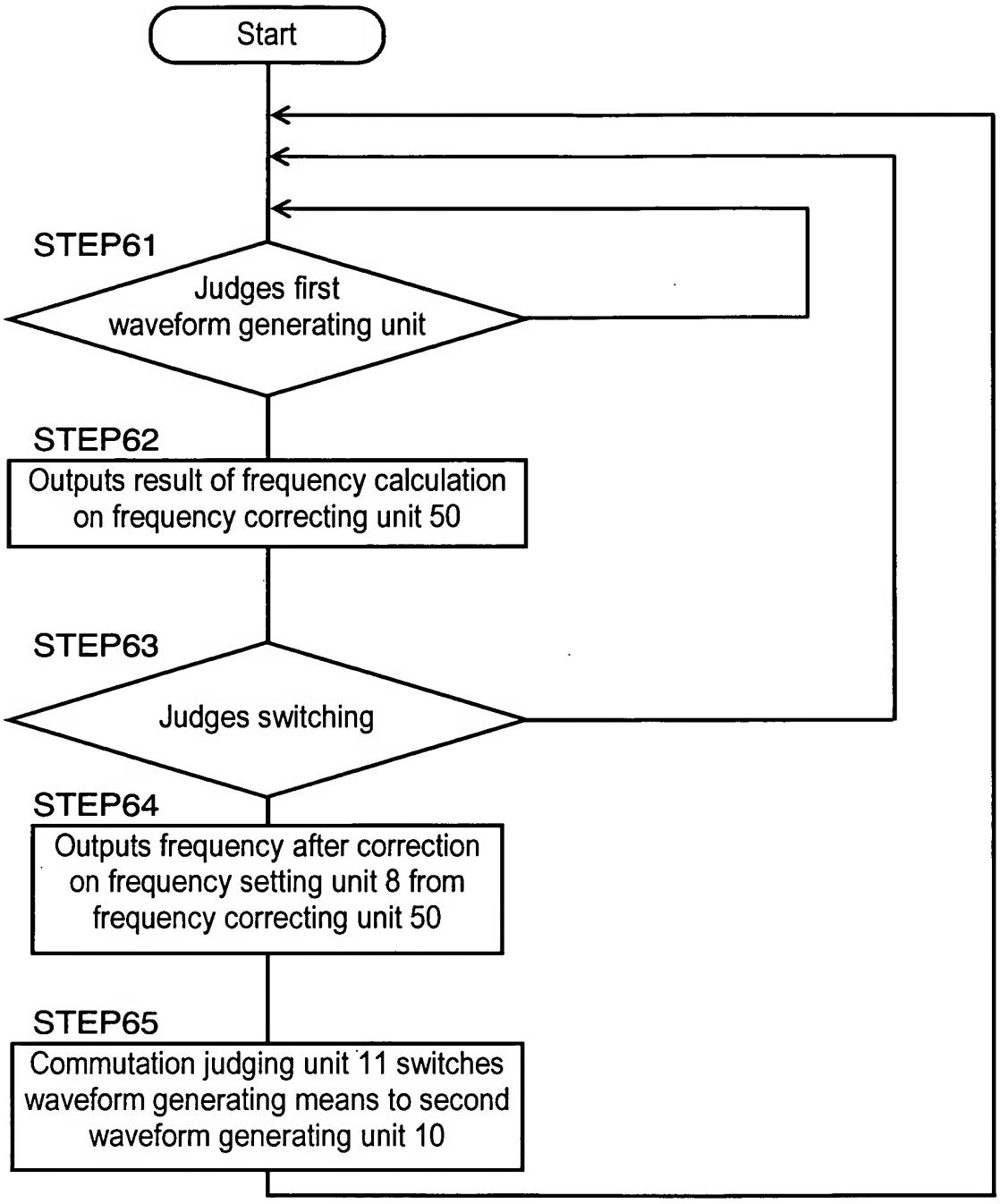

Start
STEP61
Judges first waveform generating unit
STEP62
Outputs result of frequency calculation on frequency correcting unit 50
STEP63
Judges switching
STEP64
Outputs frequency after correction on frequency setting unit 8 from frequency correcting unit 50
STEP65
Commutation judging unit 11 switches waveform generating means to second waveform generating unit 10

FIG. 15

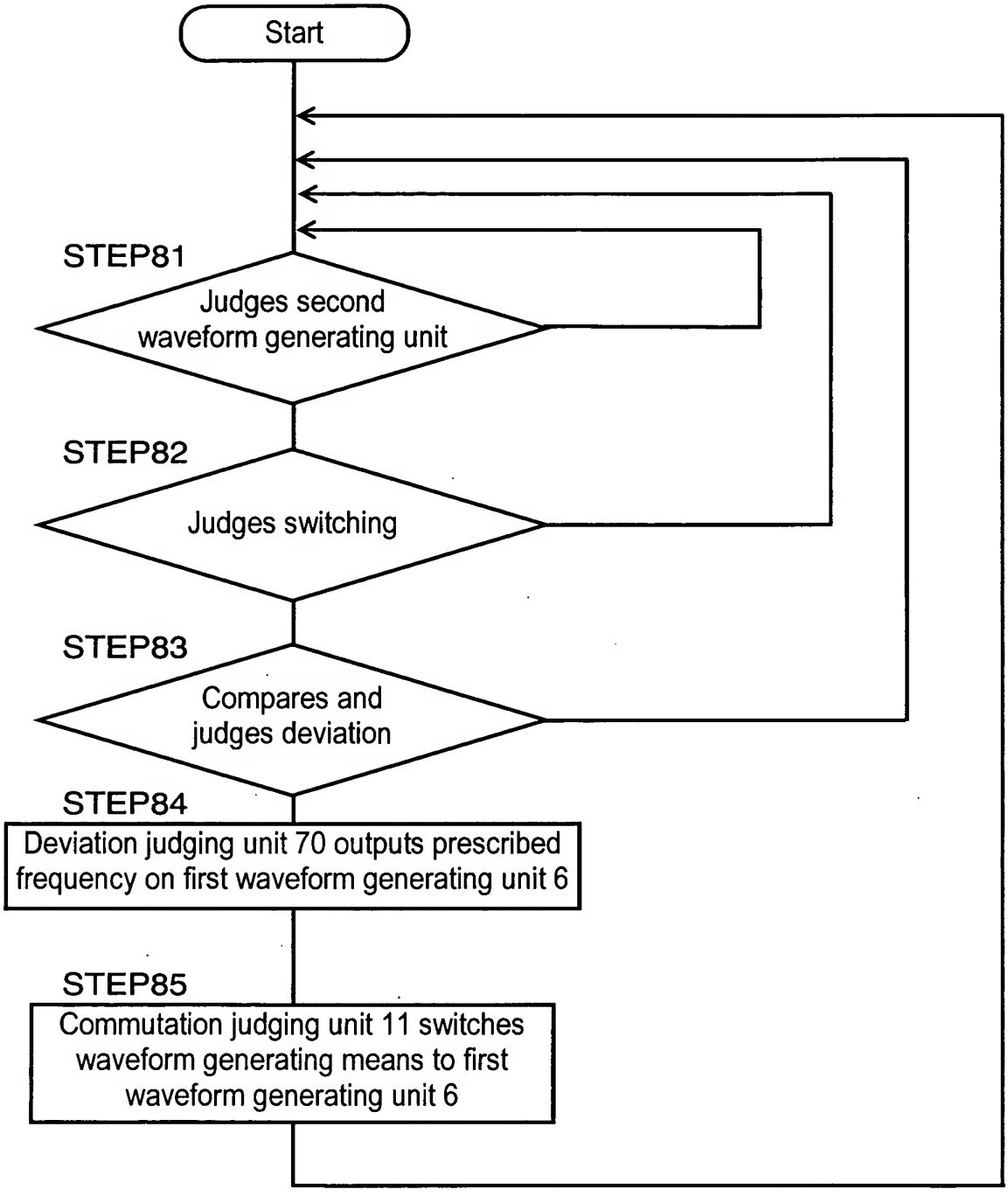

Start
STEP81
Judges second waveform generating unit
STEP82
Judges switching
STEP83
Compares and judges deviation
STEP84
Deviation judging unit 70 outputs prescribed frequency on first waveform generating unit 6
STEP85
Commutation judging unit 11 switches waveform generating means to first waveform generating unit 6

FIG. 16

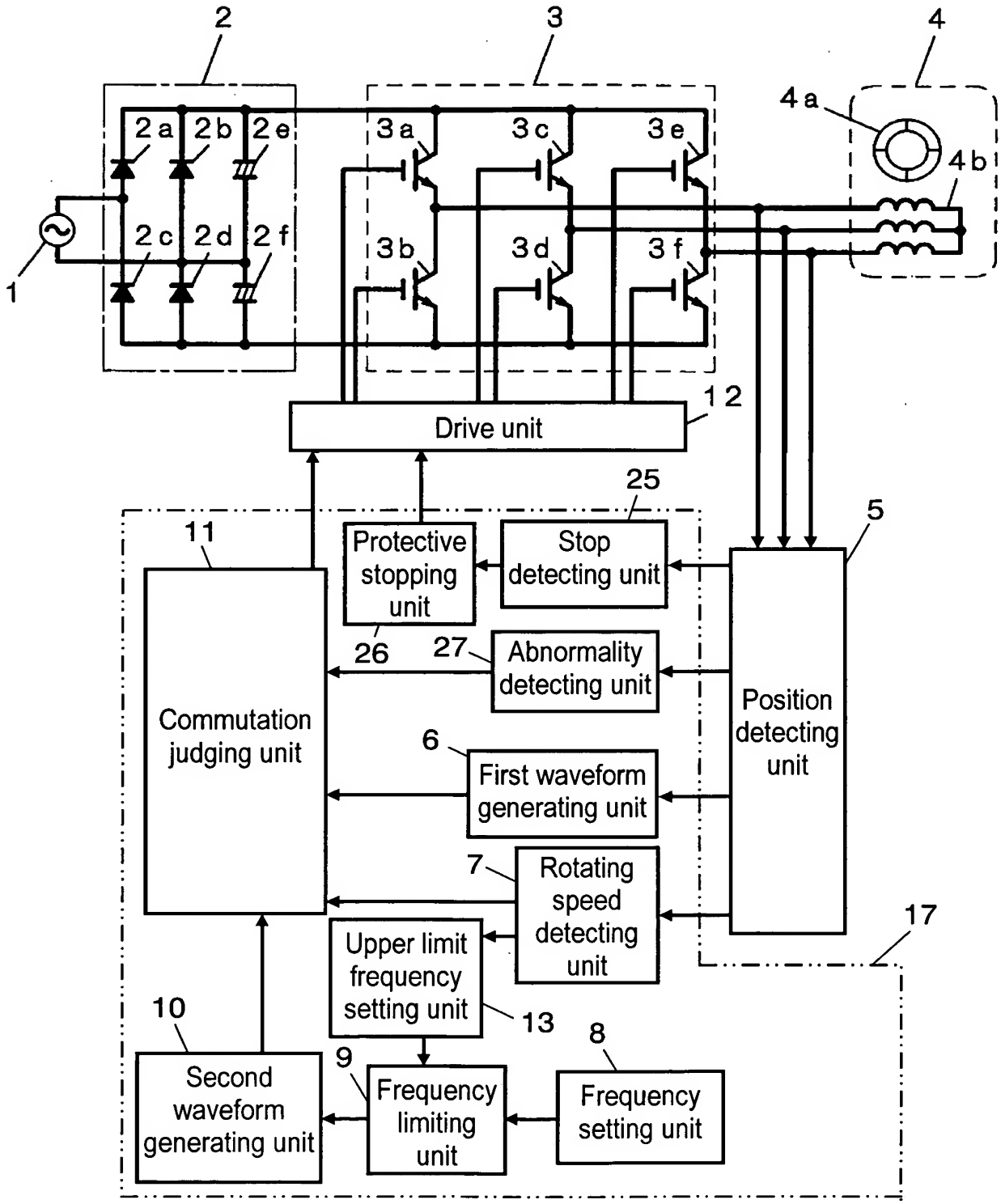

2
3
4
4a
4b
2a
2b
2e
2c
2d
2f
3a
3c
3e
3b
3d
3f
1
12
Drive unit
25
5
11
Protective stopping unit
Stop detecting unit
26
27
Abnormality detecting unit
Commutation judging unit
Position detecting unit
6
First waveform generating unit
7
Rotating speed detecting unit
17
Upper limit frequency setting unit
13
10
8
9
Second waveform generating unit
Frequency limiting unit
Frequency setting unit

FIG. 17

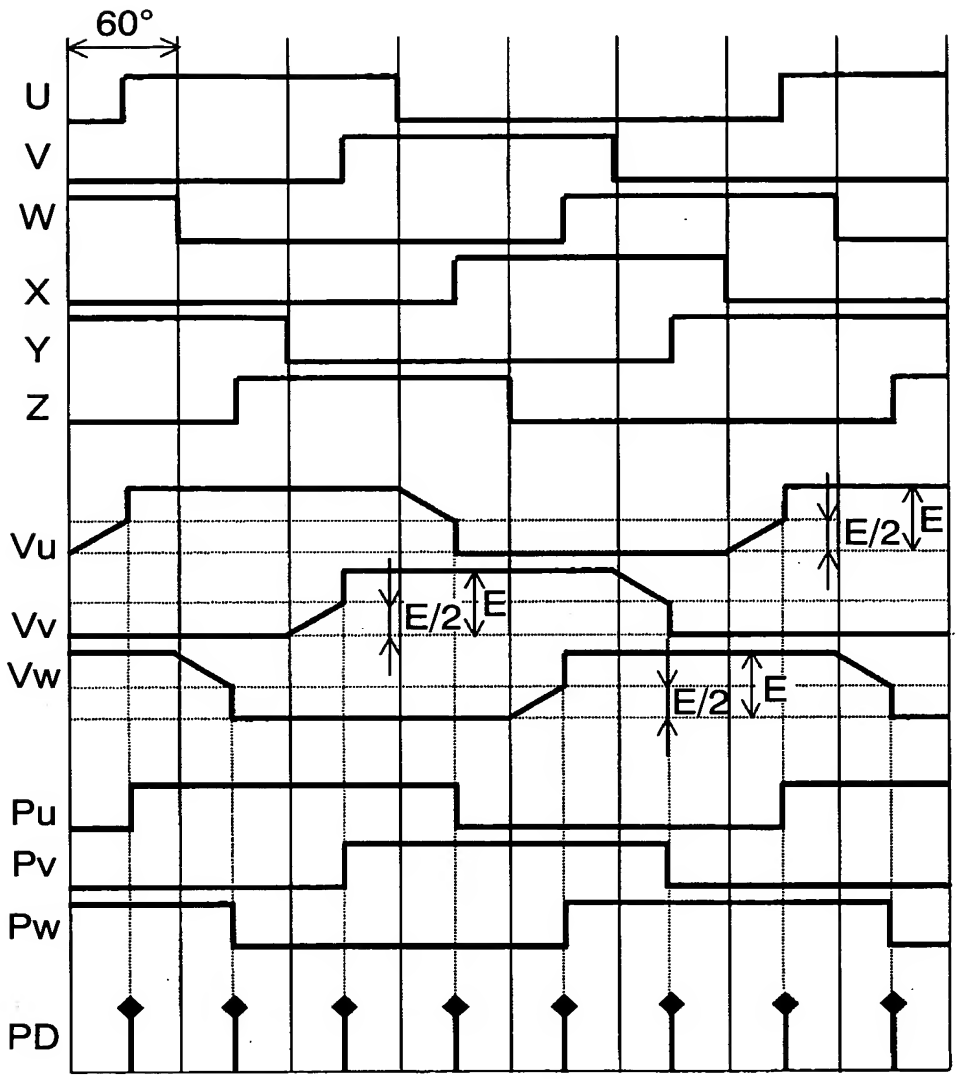


FIG. 18

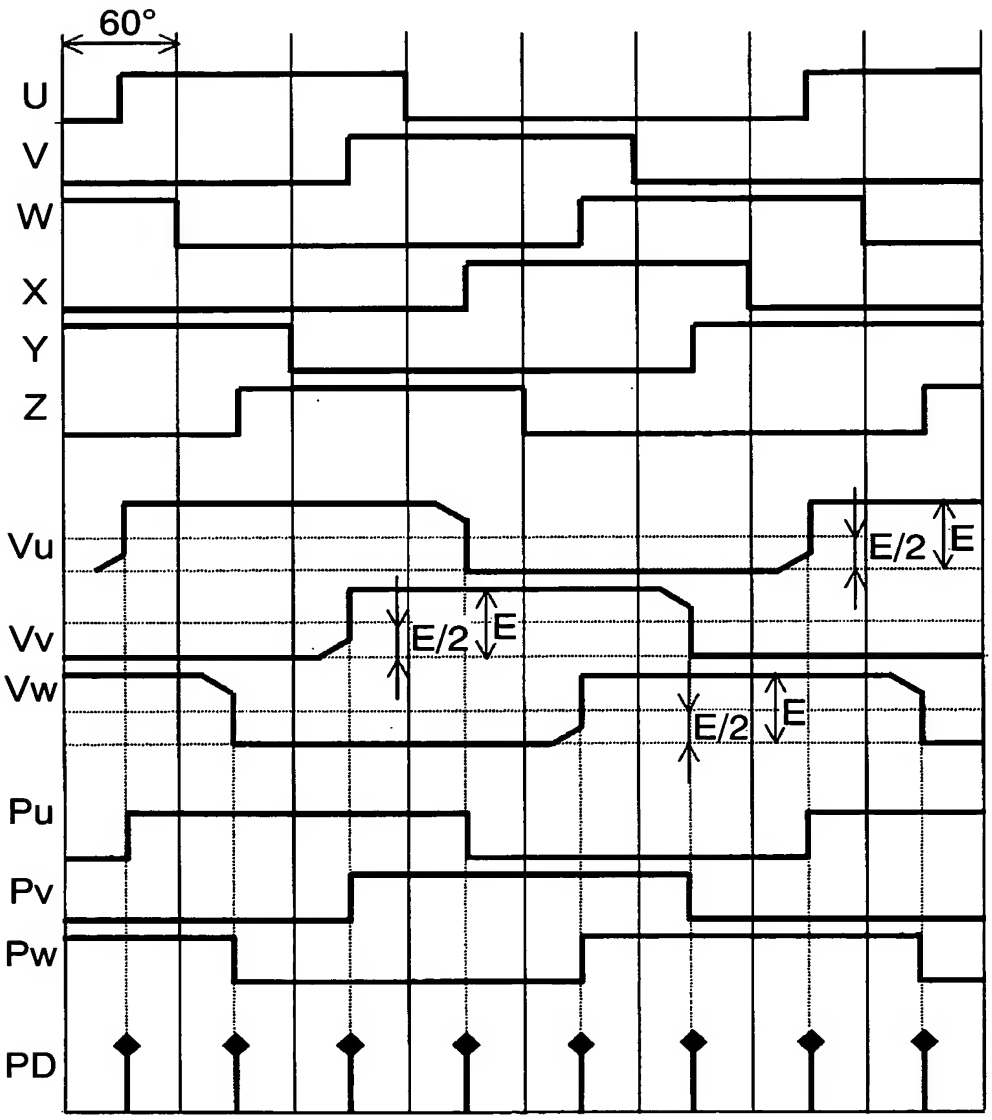


FIG. 19

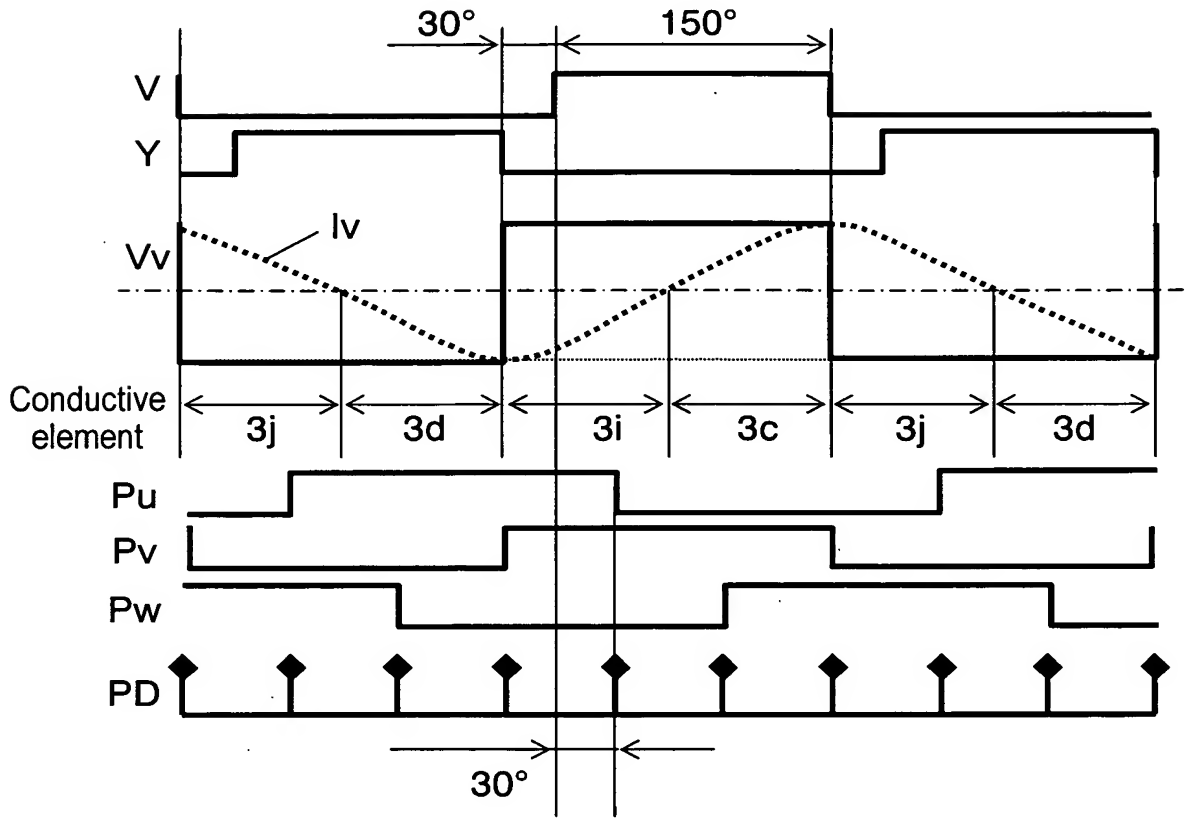

30°
150°
V
Y
Iv
Vv
Conductive element
3j
3d
3i
3c
3j
3d
Pu
Pv
Pw
PD
30°

FIG. 20

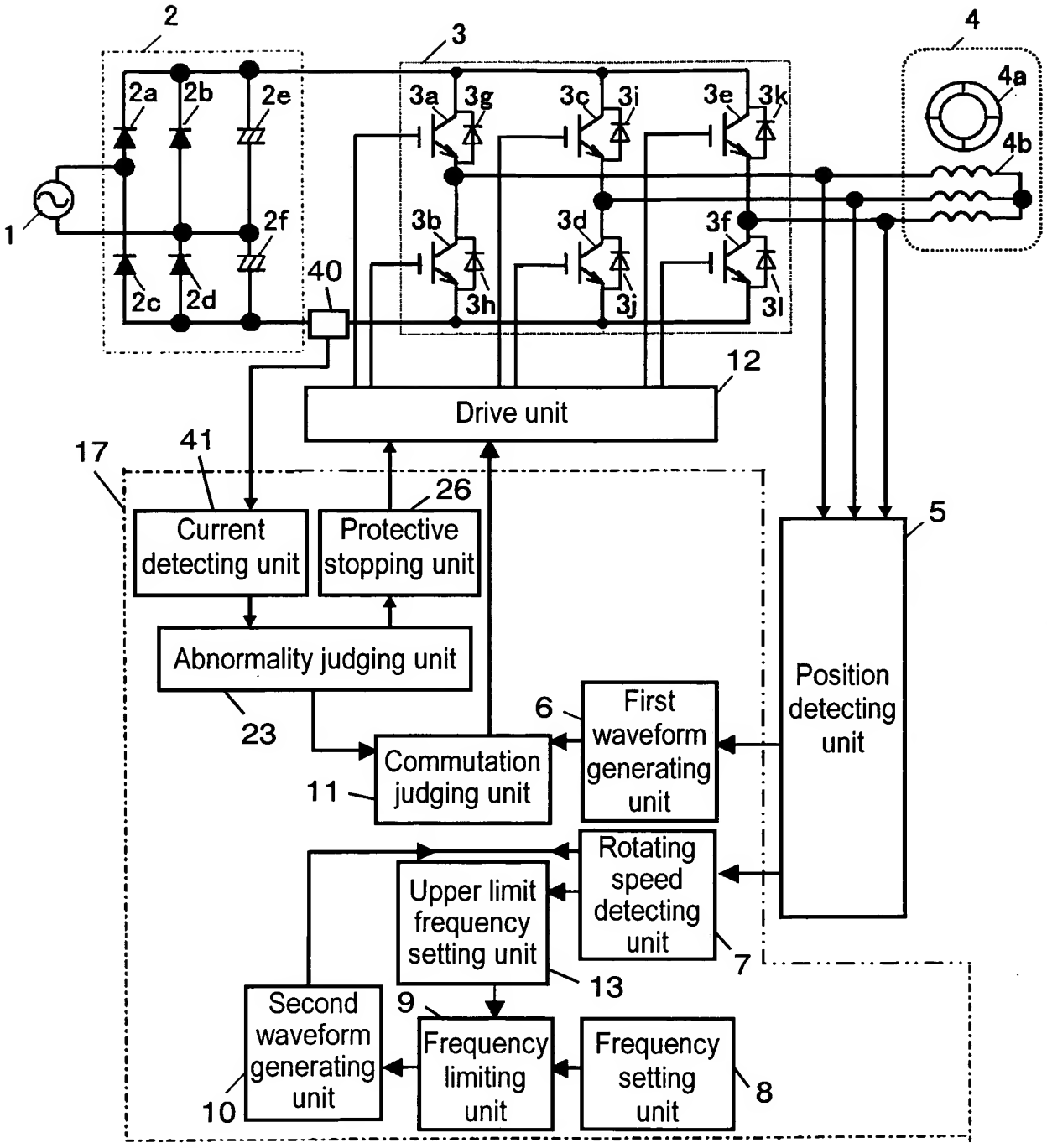
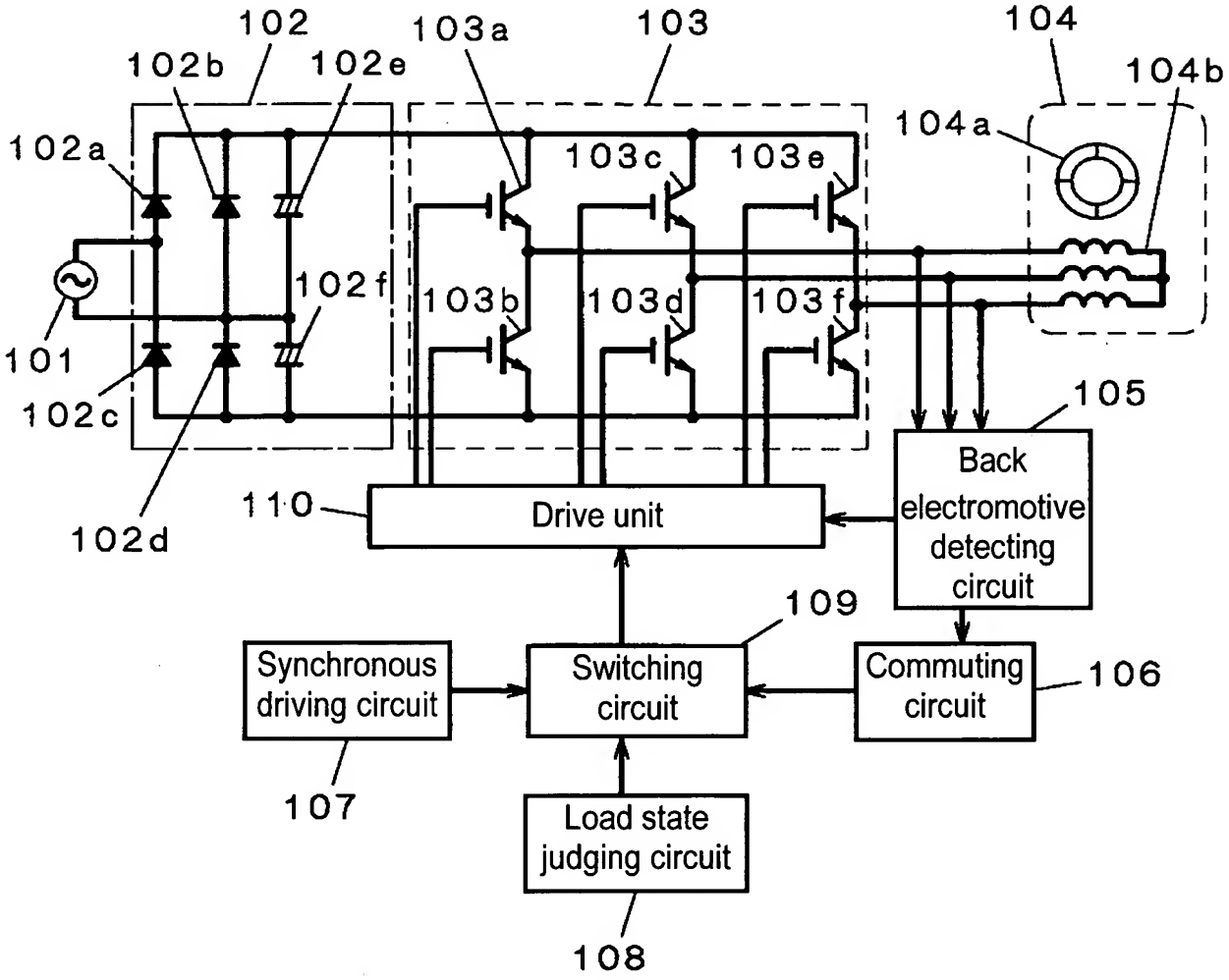

2
3
4
2a
2b
2e
3a
3g
3c
3i
3e
3k
4a
4b
1
2f
3b
3d
3f
2c
2d
40
3h
3j
3l
12
Drive unit
17
41
26
5
Current detecting unit
Protective stopping unit
Abnormality judging unit
23
6
First waveform generating unit
Position detecting unit
Commutation judging unit
11
Rotating speed detecting unit
Upper limit frequency setting unit
7
13
9
Second waveform generating unit
Frequency limiting unit
Frequency setting unit
10
8

FIG. 21


102
103a
103
104
102b
102e
104b
102a
103c
103e
104a
102f
103b
103d
103f
101
105
102c
Back electromotive detecting circuit
110
Drive unit
102d
109
Synchronous driving circuit
Switching circuit
Commuting circuit
106
107
Load state judging circuit
108

Reference numerals in the drawings

3	Inverter
4	Brushless DC motor
5	Position detecting unit
6	First waveform generating unit
7	Rotating speed detecting unit
8	Frequency setting unit
9	Frequency limiting unit
10	Second waveform generating unit
11	Commutation judging unit
12	Drive unit
13	Upper limit frequency setting unit
14	Upper limit frequency changing unit
16	Upper limit frequency correcting unit
22	Frequency commanding unit
23	Abnormality judging unit
25	Stop detecting unit
26	Protective stopping unit
27	Abnormality detecting unit
30	Output voltage detecting unit
40	Shunt resistor
41	Current detecting unit
42	Phase difference detecting unit
43	Amplitude detecting unit
50	Frequency correcting unit
60	Coincidence judging unit
70	Deviation judging unit